# BULLETIN

of the

# National Association

of

# Nurse Anesthetists

May, 1935

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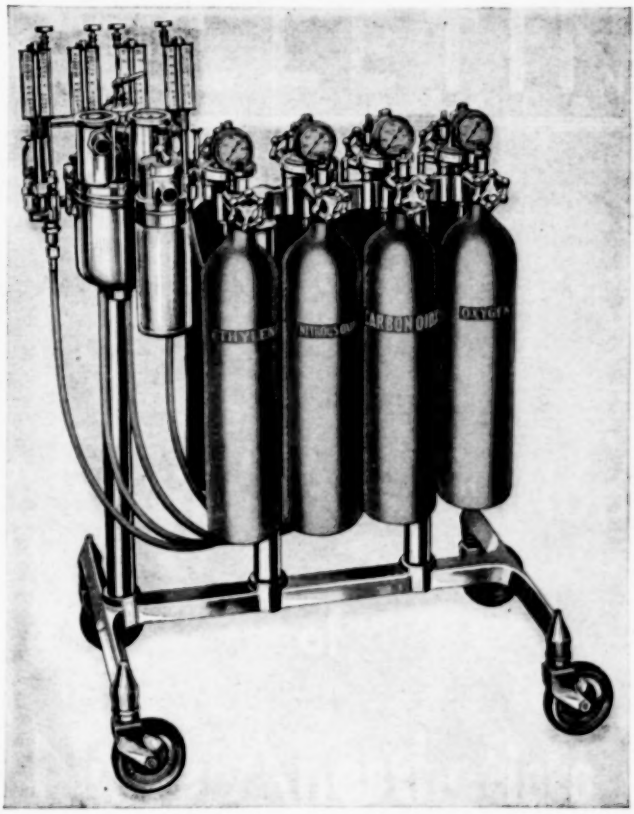


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**The third annual meeting of the National Association of Nurse Anesthetists will be held in St. Louis, Mo., October 1st, 2nd and 3rd, 1935, in conjunction with the American Hospital Association. We expect a record attendance at this meeting, and an interesting and instructive program is being prepared.**

# ANESTHESIA IN PULMONARY DISEASE

Edgar Mayer, M.D., Assistant Professor Medicine, Cornell University Medical School

"Of the tripod of life, lung, heart, brain, it is the lungs which have the most vital function in the body," concluded Bichat, the great physician-philosopher, from his contemplations on life and death. The truth of this is perhaps never driven home to us quite as clearly as when we are anxiously watching the respiration of our patients under anesthesia. We have learned that the breathing is that flywheel of life not to be lost sight of for a single moment in the course of anesthesia.

Anesthesia and respiration are linked together most intimately in a problem complex in which we are still seeking the light. We realize it is most unfortunate that nature should have mixed the blessing of anesthetic pain prevention with the danger of interference with the most vital function of the body—respiration. When we have to anesthetize a patient for operation relative to the lungs, it is still more unfortunate that the organ which is the site of the surgical intervention has at the same time also the function most concerned in anesthesia.

The special difficulties and particularly anesthetic problems arising from this complication are obvious. They are still the object of much discussion. Modern anesthesia has developed into a great science. We have repeatedly been told of late that modern thoracic surgery has been made possible by the recent great progress in the science of anesthesia. However, it may also be said that the exigencies of modern thoracic surgery served greatly to spur the ceaseless efforts toward solution of its anesthetic problems.

It is with these problems that this presentation intends to deal. Anesthesia being in the first place a surgical problem, it would seem an intrusion for a medical man to take up the subject. However, I must remind you that we who specialize in pulmonary medicine are in a unique position. Unlike in other fields of practice, here it is we medical men who set up the indications for and determine the type of operation to be done. We have to determine the fitness of our patient for the particular intervention. Preparation of the patient and his post-operative care are much our responsibilities. We never really surrender our patient. It is my contention that we should also be consulted as to the choice of the method of anesthesia to fit the case since it is we who know best the special circumstances which prevail in the individual case.

For this reason we must of course become familiarized with the problems of anesthesia in general and its implications in surgical intervention upon "pulmonary" patients in particular. I will attempt here to review these problems, both from the functional theoretical as well as practical standpoint. Our chief interest here will be the manner in which function of the lung is concerned in anesthesia and the particular difficulties and dangers which arise in surgical interventions on patients with pulmonary disease, the majority of whom in our field are tuberculous patients.

## Aims of Anesthesia

We might fittingly begin our discussion with the question of "why anesthetize?" I believe I am not mistaken when I presume that the answer to this question — even today and even among professional confreres, doctors and nurses — would be for the most part that anesthesia serves only the purpose of *pain prevention*. This answer is all the more amazing since judging from the vast amount of discussion in recent literature, we are about to enter into a period of medicine in which the effect of psychic over somatic function is likely to become much overemphasized.

With regard to anesthesia it has been recognized for some time that its role in *psychic protection* is just as significant as is the *somatic protection* it affords. In plain words, the alleviation of mental anguish is just as important as is the relief of physical pain. The value of a quick anesthetic, bringing restful sleep to a patient tortured by fear, anxiety and suspense, is hard to overestimate. There could be no more fitting term for this than that applied to it, namely, "psychic protection." In the patient who is brought to the operating table pallid with fright and frequently on the verge of shock, we have the most conspicuous example of what psychic excitement can do to somatic functions.

The counterpart of this we have of course in the shock produced by great physical pain which is also transmitted to all other functions of the body by intermediation of the brain. As Crile showed, for "somatic protection" during the operation itself it is necessary to exclude all afferent impulses from the brain.

Thus the purpose of anesthesia is not merely to protect the patient from such pain as we might inflict upon him in the course of the operation, but also to protect him, so to say, against himself.

In this connection it is pertinent to point out here that our choice of the method of anesthesia to be employed in the individual case must obviously take into consideration the psychic character of our patient as well as his physical condition.

## Nature of Anesthesia

Our next question should be, "What is anesthesia?" In the light of modern physiologic data the current textbook definition of anesthesia as being merely a depression of the function of the central nervous system, will have to be modified somewhat. Here again we will have to take into consideration the demonstrated role of central nervous system function in the co-ordination of the component organ and tissue functions, making up somatic body function as a whole. There is ample evidence that anesthesia affects body function as a whole, most probably indirectly by way of interference with its co-ordination. However, since we do not as yet know the exact manner in which anesthetics act, we cannot answer that question and must content ourselves with some of the known facts.

We do know that anesthetics depend for their action in the body upon their *concentration in the blood*. In the case of inhaled vapor and gas anesthetics this depends upon the *pressure in the alveolar air*. The brain being the most perfused tissue in the body it is explained that it becomes

first and most affected. There is also evidence that narcosis is associated in some unknown manner with an interference of *tissue oxidation* processes. Indeed, it used to be believed that narcosis is due to *tissue asphyxia*, but today we know that the latter is the sequel rather than the cause of narcosis. It has been conclusively demonstrated that oxidations and irritability are interdependent phenomena. Nervous tissue is of course by far the most sensitive structure in the body, the function of which is most dependent upon intact oxygen supply. Under the effect of anesthetics abolition of function follows in reverse order that of the evolutionary development of the levels of intellect. The brain centers concerned in consciousness and voluntary function and sensation are affected first. The brain centers controlling involuntary and vegetative autonomic functions are abolished last and only with high concentrations of the anesthetic drug.

We may define surgical anesthesia as that zone which exists between extinction of most deep reflexes (muscle tone) and depression of respiratory center. Interference with function of respiratory center leads rapidly to death. The extent to which concentration of the anesthetic must be carried after loss of consciousness to affect the respiratory center varies from one individual to the other as well as from one drug to the other. In some cases the zone is rather narrow for safety. The peripheral respiration depends in turn upon that finely adjusted functional balance between the voluntary neuromuscular apparatus of the chest wall and diaphragm and the involuntary autonomic neuromuscular apparatus of the lungs themselves.

The *respiratory center* happens to be more sensitive than the other medullary centers. According to our present knowledge the respiratory center functions autonomously, its rhythmic impulses being generated in its own tissues. It is well recognized however that this generation of impulse is conditioned on stimuli arising in the peripheral structures functioning in the peripheral respiratory mechanism. For the brain center of respiration to function efficiently it has to depend on the intact message transmission of the situation at the periphery at every moment. In surgical anesthesia with general nervous irritability and reflexes of muscle tone abolished throughout the body or even with spinal or local anesthesia eliminating afferent stimulation, pulmonary function comes to depend entirely on the involuntary autonomic apparatus. This involves a reduction of function to a basal life level, in which to use the term of Cannon: "the margin of safety is lacking."

What we just said about pulmonary function applies to practically every function of the body. It is not yet generally realized that efficiency of somatic body function and particularly that of the most vital functions, respiration and circulation, is greatly dependent upon the co-ordinating activity of nervous function as centered in the brain. The recent histomorphologic revelations of Stoehr and his pupils demonstrated the anatomic substrate of that direct physical nervous control which is exercised by the brain upon almost every cell of the body.

Because of the immediate dependence of all functions of the body upon co-ordination by the central nervous system, *bodily function* as a whole is undoubtedly affected by anesthesia. To be sure bodily function

as a whole is not interrupted, in any sense, during that peculiar state known as anesthesia. As little as we know about the events which occur in that period between sleep and death which we call anesthesia, it is certain that we must not think of it merely as a form of sleep.

Clearly, anesthesia implies not only a temporary abolition of brain function but also a general reduction to a lower level of bodily function as a whole. In plain words it implies a reduction in vitality. It means that under its circumstances the balance of function is so easily upset by emergencies which are ordinarily overcome as a matter of normal exertion.

It is an outstanding feature of anesthetic action that it is ordinarily reversible and removal of the drug restores the nervous system to original activity without damage. Anesthesia being but temporary, the reduction in vitality it implies is of course also but temporary. However, the length of time anesthesia must be maintained for any surgical intervention is a matter of considerable significance. Also the vitality level of the patient about to undergo anesthesia is a matter of great importance. For a patient with low vitality anesthesia may prove that last bit which will throw the balance of functions in the wrong direction. Indeed, in the days before we developed our present-day mastery over anesthetic technic, many a patient slipped out imperceptibly, but irrevocably from his twilight life into death. No wonder Barton called anesthesia the backwaters of Lethe.

### Anesthesia and Breathing in General

Sir Francis Hewitt, the great British anesthetist, emphasized that "maintenance of an efficient ventilation of the lungs is the first essential in giving an anesthetic." In the course of anesthesia, breathing may become interfered with in many different ways. The more important of these possibilities are as follows:

1. The anesthetic gas or vapor may produce *anoxemia* by reducing the tension of oxygen in the alveolar air or by interfering with oxygen carriage in the blood. Particularly, closed methods and the use of nitrous oxide or chloroform is likely to produce anoxemia.

2. Carbon dioxide tension, too, may become reduced in the blood chiefly by way of over-breathing in the first part of the anesthesia; in such hyperpnea, acapnia can become rather dangerous particularly if it is complicated with anoxemia.

3. Breathing during anesthesia may become interfered with by obstructions of the air passage due to muscle spasms or paralysis, or to accumulation of normal lung moisture or excessive secretions, the elimination of which is disturbed.

4. Finally, overdosage of the anesthetic, *depressing the respiratory center*, is a distinct danger with some anesthetics in certain people.

### Special Exigencies of Anesthesia in Patients with Pulmonary Disease

It has repeatedly been pointed out that there are few surgical patients who are more dependent on the anesthetic and the method of its administration for their immediate and remote safety than are "pulmonary" patients. To the above enumerated possibilities by which respiration

may become interfered with in anesthesia in general, there must be added several more serious implications of breathing in anesthesia in such patients.

To begin with, of greatest importance is the fact that we have to anesthetize a patient whose pulmonary function is already affected by preceding disease of the organ. The least we can say is that such a patient has lost a great deal of his normal functional reserve, that he may indeed have a rather narrow margin of safety in his respiratory function. The specific implications may be as follows: Our patient may be one whose respiratory function is already adjusted to increased requirements in face of failing efficiency of function. It may be keyed to a degree of sensitiveness making dangerous already such milder degrees of reduction in function as is involved in the anesthesia he is to be subjected to. For example, our patient may be one in whom the peripheral respiratory reflexes or particularly the cough reflex must under no circumstances be abolished for the reason that the breathing economy of our patient depends vitally on the continuous stream of pulmonary reflexes, or that our patient already has more moisture in his lung than he can take care of without a most efficient cough mechanism. As another example, our patient may be one in whom the balance between intrapulmonary and intrathoracic tensions cannot be interfered with for a single moment without throwing his functions out of balance, particularly not while he is in a state of unconsciousness or while his peripheral reflexes have been abolished, making quick adjustment rather difficult or impossible. Finally our patient may be one who under no circumstances will suffer further reduction of pulmonary surface or encroachment upon his intrathoracic space to any extent, particularly not under anesthesia, for the reason that he either has no lung space to spare or cannot stand further loss of facility to ventilate.

Anesthetists dealing with such patients were until quite recently greatly concerned with the *maintenance of the physiologic tension in the lungs and chest*. On this subject literature even quite recently dealt exhaustively with the details of technical methods to provide differential pressures for thoracic operations and methods of insufflation to furnish positive pressure for intrapulmonary interventions. The fact is that tension conditions, particularly the balance between the intrapleural and intrapulmonary pressures, play a paramount role in respiro-circulatory function of the body. Maintenance of balance in these tensions depends on efficient movement of the chest wall, on the one hand, and an uninterrupted circulation and gaseous exchange in the lungs on the other. In the course of anesthesia in operations on and within the chest there may arise interferences with the above factors. Vast experience indicates that particularly sudden reduction of the alveolar gas tensions, namely, of intrapulmonary pressure, and sudden decrease or increase in intrathoracic pressure in connection with abrupt opening of the chest wall, creation of pneumothorax, collapse of a lung, flooding of the air spaces with a gas or vapor to the partial exclusion of the respiratory gases, play a vital role in respiro-circulatory function. The emphasis is rather on the abruptness and suddenness of these complications requiring quick functional compensatory adjustment rendered difficult or impossible in the state of

anesthesia. We now find that by bringing about the tension changes gradually instead of abruptly, we can dispense with the complicated apparatus mentioned.

A factor yet little appreciated in anesthesia of "pulmonary" patients is that of interference with the physiologic function of the lung that eliminates moisture. It is not yet fully realized that vast amounts of fluid are constantly filtered into the air spaces in normal lung and that the elimination of this moisture from the breathing surface by evaporation and filtration depends on efficient pulmonary function. Anesthetists speaking of the tendency to accumulation of excess secretions particularly in the course of inhalation anesthesia are really referring to this complication. Namely, even short interference with pulmonary circulation, ventilation and gaseous exchange may result in congestion of the vast capillary bed of the lungs, inhibition of the pulmonary tissue and in inundation of the air spaces and passages. Furthermore anesthetics, as well as operations upon the chest, may cause obstructions of the air passages, interfere with chest movements, or chill the lungs, and so interfere with normal ventilation and evaporation. The result is disturbed elimination of the physiological moisture from the lungs and embarrassed respiratory and circulatory function.

Furthermore, pulmonary function plays a major part in gaseous exchange between blood and air of the lungs, as well as in the transmission of blood through the lesser circuit. The recent revelations of the role of the carotid-sinus reflexes that connect the lung and heart in the autonomous respiratory-circulatory vegetative function, is the strongest link in the evidence of the unity of these functions. The implications are that proper breathing is a prerequisite to efficient circulation and proper circulation is a condition sine qua non of efficient breathing. Failure of one involves failure of the other function. The carotid reflex mechanism acts in bringing about compensatory adjustments mutually possible between the two, but the same reflex mechanism may also involve functional failure of both almost immediately. This explains the phenomena of collapse of the circulation and respiration termed "*surgical shock*," usually beginning with respiratory symptoms in the course of or following surgery with anesthesia. The part played by the anesthesia and by the operation is never quite sharply definable.

And so, in the question of the special implications of anesthesia in pulmonary patients one can say that efficient pulmonary function which includes both internal and external respiration is the key to maintained body vitality. Anesthesia implies a certain amount of reduction of this. Disease of the lungs implies a still greater reduction. The combination of the two with all their attending sources of danger frequently make for a vicious cycle which may prove fatal.

The determination of the fitness of a patient with respiratory disease to undergo anesthesia for operation is by no means an easy matter. In connection with tuberculosis, much attention has been paid to the possibilities of spreading or lighting up the old pulmonary disease, but little consideration has been given to the effect of the anesthesia and operation upon the vitality and resistance of our patient in general. The danger of lighting up the disease, in our opinion, is really less attributable to a

local effect of the anesthesia than to the damage to the patient's general vitality. Our judgment as to fitness for operation must frequently depend upon a correct estimation of the general resistance of the patient. Great efforts are recently being made to utilize functional respiratory and circulatory tests to estimate this more precisely. For the time being vitality is still much of an imponderable factor.

Thus the determination of the fitness of such a chronic patient to undergo anesthesia for operation is by no means an easy matter. Patients with ebbing vitality, regardless of how brought about, succumb for the most part soon or late after the operation, to pulmonary failure, as evidenced by terminal lobar pneumonia, bronchopneumonia or pulmonary oedema. In tuberculosis patients there may appear a rapid extension of the process or a generalization of the disease as a miliary tuberculosis. Whether this is due to the anesthesia "per se" or to the effect of the operation as a whole is impossible to say.

### Requirements of Anesthesia in Thoracic Diseases

Hewer C. Langton has stressed that the ideal anesthetic and the method of its administration for thoracic surgery should insure the patient:

1. An easy induction and an easy maintenance of anesthesia without respiratory effort.
2. Absence of anoxemia and toxemia.
3. Ability to produce and maintain at will positive intrapulmonary pressure.
4. Action of the anesthetic that will cease with its administration.
5. Provision of adequate facilities for aspirating secretions away from the lungs.

The anesthetic agents to approach this standard, he stated, were nitrous oxide gas and ethylene gas. He strongly advocated endotracheal anesthesia.

As a result of thirty years of clinical research at Rush Medical College, Bevan made a study of the requirements of the various anesthetics from the following standpoints:

The safety and comfort of the patient, the efficiency of the anesthetic agent, control, using only anesthetics that can be withdrawn at the first sign of danger, elimination of psychic trauma by abolishing pain and consciousness; simplicity and general adaptability of the method; absence of injurious effects on organs, tissues and blood; absence of complications such as vomiting, headache and delirium; absence of effects that lower resistance to organisms such as pneumococci and streptococci.

He concluded that the use of chloroform, of intraspinal, intravenous, intrarectal, intratracheal and of the so-called basic anesthetics such as scopolamine, avertin and amytal must be limited to very narrow fields. Local, gas and ether anesthesia afford those measures which if handled expertly can be used alone or in sequence, with abolition of pain and if desired the abolition of consciousness, and when required, complete relaxation, and can secure complete and safe anesthesia for any and all

surgical operations. Most of the operable cases in thoracic surgery he found could be done under local anesthesia, drop ether, ethylene or nitrous oxide and oxygen. Since Bevan's report, intraspinal anesthesia and the use of avertin (tribrom-ethyl alcohol) have shown a much wider field of application, but the use of avertin in thoracic surgery has often proved harmful by depressing the cough reflex postoperatively.

In summary, it is not possible to enter into a detailed discussion of the advantages and disadvantages of the different methods of anesthesia in thoracic operations in pulmonary patients. Judging from expert studies there exists no ideal method answering all requirements. In this country for tuberculous patients the tendency has been to favor nitrous oxide gas or ethylene with oxygen by intrapharyngeal through nasal catheter or endotracheal insufflation. Particular attention is paid to maintenance of proper gas tension in the sound lung, if necessary through a catheter in its main bronchus, when the other lung is the site of operation, or if the patient has to lie on his sound side while the affected side is being operated upon. This technic is combined with proper provisions for keeping the air passage free by suction. Ether is usually avoided. Eminent chest surgeons, especially abroad, still consider local anesthesia the method of choice although the great danger of aspiration is recognized, and the patients are wont to be so overanxious that some degree of general anesthesia is frequently desirable. Many surgeons seek solution of the problems in a combination of general and local methods, using nitrous oxide for induction of light general anesthesia throughout and depending on local anesthesia for execution of the more painful parts of it.

Spinal anesthesia is not usually used for operations above the diaphragm.

For operations performed outside the chest field upon patients with pulmonary tuberculosis or other pulmonary disease, local and spinal anesthesia are usually preferred. If general anesthesia is necessary, ether is ordinarily avoided, because of a strong possibility of reactivating an old pulmonary focus of disease or extending a more recent lesion. Ethylene and nitrous oxide-oxygen gas are usually employed.

In concluding, may I explain that this presentation has stressed the broad medical aspects of the problem to the neglect of its practical side in recognition of the fact that this audience of specialists in the field of anesthesia is much more familiar with these than the writer.

(Read at the first annual convention of the New York State Nurse Anesthetists' Association, held at the Hotel New Yorker, New York City, May 24th and 25th, 1934, and published in the report of the meeting).

## A NEW USE FOR VAPEX

Three or four drops of "Vapex" dropped on the mask before ether is started seems to soothe the respiratory tract, and camouflages the odor of ether better than anything I have used.

Geraldine G. VanderBurgh, Williamsport Hospital, Williamsport, Pa.

The National Association of Nurse Anesthetists does not hold itself responsible for any statements made or opinions expressed by any contributor in any article published in its columns.

# SELECTIVE ANESTHESIA AND ANALGESIA TECHNIQUE

Lou E. Adams, Chief Anesthetist, Cleveland Clinic Hospital
Cleveland, Ohio

The rapid progress in anesthesia has, indeed, given place to a new specialty. No longer does the term anesthesia conjure the picture of a struggling, choking patient being forced to inhale some obnoxious fumes, but now means the peaceful induction of natural sleep. The patients have lost that morbid fear of the "painful operation," which made them hesitate until the last minute before submitting to the ordeal. The surgeon no longer tolerates the anesthetist as a "necessary evil and one that must be watched continuously," but he considers her a trained specialist, capable of administering a safe and satisfactory anesthetic.

The anesthetists of today have not only a great number of anesthetic agents at their disposal, but may employ many different methods of administration. They have a practical knowledge of all anesthetic agents, their uses and limitations, their combinations and sequences, their pharmacological and physiological reactions, and their clinical applications, and are proficient in the various methods of administration.

When selecting an anesthetic, the question of safety is of paramount importance and should predominate all other considerations. Science has been unable to develop any local or general anesthetic agent that is devoid of all danger, and it is only through the recognition of this fact, by the anesthetist and the surgeon, that the mortality and the post-operative complications can be minimized.

Unfortunately, the administration of any general anesthetic agent is accompanied by a pronounced physiological disturbance. The nausea, the vomiting, the perspiration, headaches and profound weakness are but simple testimonials that the body has been affected by some harmful substance. Loss of consciousness and response to painful stimuli indicate that the functional capacity of the brain has been reduced to a low level —the deeper the narcosis, the more pronounced the depression. While the purpose of anesthesia is to prevent pain perception, the effects of the anesthetic agents cannot be confined to the nervous system. The inhaled ether fumes, or the absorbed avertin substances permeate every tissue of the body. The muscle fibers of the heart, the Kupffer cells of the liver, and the renal glomeruli are all saturated with these protoplasmic poisons. The degree of toxicity and the amount of physiological depression, which the various anesthetic agents exert, depends on their concentration and duration of contact. Fortunately, the functional reserve of all vital organs is usually ample to compensate for the anesthetic results. However, diseases can so diminish the vital capacity of these essential organs that their reserve is exhausted. To increase the load of the overburdened heart, kidneys, liver and brain by saturating their cells with depressing anesthetics is adding insult to injury. Paradoxical though it may seem, the more serious the disease, the less anesthetic the patient can tolerate. It must be borne in mind that such poor-risk patients cannot safely endure even a mild degree of suboxidation. Patients with malnutrition, pyloric obstruction, carcinoma of the intestinal

tract, severe hyperthyroidism, and with diseases of the gall bladder and common duct constitute bad anesthetic risks. In such subjects, a deep anesthetic merely assists the disease to destroy the patient rather than to aid the surgeon to facilitate a recovery. While chloroform, ether, avertin, ethylene, nitrous oxide and other anesthetics all succeed in depressing the central nervous system, they also exert a harmful effect on other body tissues.

Recognition of the dangers and hazards of general anesthetics led to the introduction of regional anesthesia. Local infiltration, paravertebral blocks and intradural injections of numerous substances have been advocated. However, all substances used in regional anesthesia are protoplasmic poisons, but, fortunately, their action is confined to small groups of tissues at the site of injection. For example, in spinal anesthesia, the anesthetizing substance is brought into direct contact with the sensory nerves as it enters the spinal cord, and produces a molecular change in the nerves such as to prevent the transmission of painful stimuli from the operative area to the brain. Therefore, the heart, kidneys, liver and brain do not come in direct contact with the anesthetizing substance and are not affected by them, except in an indirect manner. Unfortunately, the function of all vital organs is dependent on a normal neurogenic control and ample blood supply, and interference with either of these systems diminishes the functional capacity of the affected organ. A spinal anesthesia interferes with the visceral innervation and produces a vascular stasis in the splanchnic vessels and, in this indirect manner, is capable of initiating undesirable systemic reactions.

The principle of local and paravertebral anesthesia is sound. The efferent pathways, over which the pain-producing stimuli travel are blocked, and the cerebrum cannot be bombarded by repeated peripheral impacts, hence the shock is minimized. However, one cannot avoid the psychic trauma that often arises in emotional, apprehensive patients, and general anesthetics must be resorted to in these subjects. Occasionally, one encounters a peculiar sensitivity or idiosyncrasy to these local anesthetic agents, and a profound systemic reaction may follow.

In selecting an anesthetic, one must not only consider the physiological actions of the drugs, but must evaluate the emotional and physical characteristics of the patients. Children and nervous, apprehensive adults do not give the intelligent cooperation that is required for a successful spinal or local anesthesia. Elderly patients, whose vital organs have undergone the degenerative changes incident to senility, do not tolerate a deep anesthesia. Chronic alcoholics and drug addicts are merely stimulated by nitrous oxide and ethylene gases, ether then becoming the agent of choice. Associated physical defects, such as pulmonary infections, cardiac decompensation, Bright's disease, arteriosclerosis and hypertension, dictate the type of anesthesia to be employed.

The choice of anesthetic is partially determined by the type of operation to be performed. Does it require complete muscular relaxation? How long a time will be required to complete the operation? Will the post-operative effects of the anesthesia militate against repair of the wound and recovery? For example: It is unwise to give a deep anesthetia to open a superficial abscess, and a small amount of nitrous oxide or eth-

ylene would answer the purpose. On the other hand, nitrous oxide will not give sufficient muscular relaxation to permit the reduction of fracture of the femur of several hours' duration. In repair of large ventral hernias, one selects the anesthetic that will give the minimal amount of post-operative nausea and vomiting, thus preventing undue tension on the wound. Thus, if the anesthetist is to give a safe anesthetic, and to satisfy the surgeon, she must have a comprehensive knowledge of all anesthetic agents, be skilled in the various methods of administration, and tactful in handling patients. Chloroform, ether, ethyl-chlorid, spinal, avertin, nitrous-oxide, ethylene, locals and many of the barbital products sum up the agents for anesthetic use.

For many years, except in some localities, it has been the opinion that chloroform and ethyl chlorid are much too depressing for practical use and safety. The many barbital products used intravenously are dangerous, due to the fact of rapid absorption and inability to eliminate the drugs for hours. Locals, for minor operations, answer the purpose, if the patient is understanding and cooperative. Avertin makes an excellent basal anesthetic for children and the highly nervous, due to its quiet, pleasant induction and peaceful, natural recovery. Many of the neurological surgeons feel avertin has made it possible to operate with less risk to the patient, also greater comfort for both patient and surgeon. The cerebellar tumors, the most tedious, difficult and dangerous operations, are especially facilitated and made safer, because of the smooth, regular respirations and the absence of cerebellar edema. Many of the brain operations, previously, had to be accomplished with local anesthesia or often discontinued, because the patient was fatigued, or ether and nitrous oxide were contra-indicated. I would like to quote Dr. W. James Gardner, the neuro-surgeon of our Clinic, on the use of avertin. He says, "I feel the advantages outnumber the disadvantages, because of the quiet, regular breathing, and absence of intercranial pressure it produces, for a safe and complete operation."

From 1930 to present date, 2000 avertins have been given at the Cleveland Clinic Hospital. We give 80 to 100 mg. per kilo of body weight to most of the cases. We use it only in selective cases and as a basal anesthetic for general surgery in doses of 50 to 60 mg. per kilo. The drop in blood pressure has been overcome by the use of caffein, ephedrin, adrenalin, carbon dioxide inhalations, and sometimes intravenous glucose. Our youngest patient was 3 months and the oldest 76.

Spinal anesthesia is undoubtedly the choice for combined abdomino-perineal resection for carcinoma of rectum, adrenal denervations and intra-abdominal cases demanding complete relaxation. Nitrous oxide oxygen analgesia may be used in conjunction to relieve the mental anxiety of the patient. We have used spinal anesthetics successfully in 3500 cases.

Nitrous oxide oxygen and ethylene are the choice of inhalation anesthetics, as they are non-irritating to the respiratory tract and not eliminated by the kidneys, and do not have toxic after-effects, if given with sufficient oxygen. With the present metabolic tests, we know the amount of oxygen each particular patient requires. Many patients can be carried for an hour or two without the addition of ether. If it is necessary for better relaxation, ether can be added with safety. The

soda lime filter now in use has cut down the amount of anesthetic agent necessary and gives better relaxation and softer respiration, due to the fact the excess carbon dioxide has been diminished. At the close of operation, the patient can be hyper-ventilated and awake before leaving the surgery. The old days of sending the patient back to the room to sleep for three hours is over, and the post-operative complications have been diminished. We do not have our patients in shock, and post-operative nausea is lessened. It is not advisable to use nitrous oxide for children under six, because of their immature musculature, which makes breathing into the bag difficult. Ether is our good old standby for children. If nitrous oxide with a large percentage of oxygen is given slowly and with tact, engaging the child in conversation until he becomes drowsy, a pleasant and safe induction can be induced, combining ether for desired relaxation.

### Technique of Analgesia

Webster's definition for analgesia is "absence of sensibility to pain." As applied to anesthesia, it has a specific meaning—absence of sensibility to pain—giving mental comfort and ease to the patient, without producing unconsciousness.

Let us take the hyperthyroid patient as an excellent example for selecting analgesia, instead of a deep anesthesia. The instability of the nervous and cardiovascular system in hyperthyroidism is the main factor, which influences the necessity for analgesia, as it obviates the mental anxiety of the patient without interfering with any of the vital functions. The anesthetist must always bear in mind patients with hyperthyroidism are hypersensitive to every stimuli, and fear is ever present. As a general rule, these patients are hospitalized from one to two weeks, and are instructed on admission that the operation will take place when they are rested, and they will not be informed of the day it will occur. During this preoperative period, the anesthetist frequently visits the patient, gaining his confidence, allaying his fears and forming a friendly relationship, which results in implicit cooperation during the operation. However, if the anesthetist does not have the opportunity to become acquainted with the patient before the operation, she must prove, by her actions and conversation, that she is interested solely in the welfare and comfort of the patient. An understanding sympathy, combined with frank explanations of what is being done, produces an intelligent cooperation.

Children and hyper-excitable adults are given daily inhalations of oxygen to acquaint them with the "gas mask" and to emphasize the fact that all "treatments" are harmless as well as painless. When familiar with these "breathing exercises," the patient is placed in regular operative position, and the skin is cleansed with alcohol and dressings are applied. Thus, on the day of operation, the induction of analgesia, the operative position, and preparations do not alarm the patient, for this has become a part of the daily routine.

The analgesia dosage is approximately 90 per cent oxygen—10 per cent nitrous oxide. It is fortunate that the first five minutes of nitrous oxide inhalation will exhilarate the patient and put him in a cooperative state of mind. In some cases, a larger percent of nitrous oxide will

be necessary to produce this euphoria. This must be worked out according to the individual. We try to avoid excitement, commotion, confusion and unnecessary talking, and allow only the quiet conversation of patient and anesthetist. With the patient in good analgesia state, the anesthetist quietly signals the operative team to the patient's room, and directs the skin preparation and novocain infiltration, preparing the patient in advance in a quiet, tactful way what to expect. In some cases, it may be necessary to increase the nitrous oxide to almost anesthesia to complete a satisfactory novocain block, then resume the conversation as before. At all times, let the patient hear your voice. A good analgesia depends upon a good novocain infiltration and cooperation of the entire team. Novocain, alone, or analgesia, alone, is not sufficient, but the combination is ideal. The eyes and expression of the face are our best guide; by them, you may detect pain, excitement or fatigue, before the pulse rate is affected. If the morale is poor, often a word from the surgeon will give encouragement, or, in the obstinate cases, it might require a light anesthesia, or an increase in the local infiltration; change the surgical procedure, or, if the patient manifests shock, the operation will be discontinued until next day. If excess bleeding occurs the patient will be asked to cough to test hemostasis, thus avoiding post-operative hemorrhage. The anesthetist must, at all times, have her machine within easy reach, and patient's head controlled. She must report any change in patient's pulse or morale, and constantly be on the alert for any emergency that may arise. If some difficulty in breathing is experienced, ask permission to change position of neck, which often aids the patient's comfort. The anesthetist must be prepared to administer oxygen under pressure, if necessary. If, at any time, she feels the nitrous oxide is causing excitement, give oxygen alone, to determine what is causing the excitement.

The question is often asked: "Can you use analgesia with children?" It can be applied to children as well, and sometimes better than adults, but it will take much preoperative instruction and patience on the part of the anesthetist. I have had 30 thyroidectomies in children from 4 to 14 years. Some of these children have had from one to three surgical procedures, such as ligation, lobectomy and second lobectomy. Never, at any time, have they associated me with their "sore neck." Many have sung their favorite little songs during the operation. It is fascinating, also nerve-racking, for the anesthetist, but most satisfactory to patient, surgeon and anesthetist when one sees the excellent results. We feel nitrous oxide analgesia is the safest anesthetic for all thyroidectomies, either adults or children, or any other operation where deep inhalation or spinal anesthesia are contra-indicated, because it is safe and easily controlled, mental anxiety is obviated, pleasant to take, no bad after-effects to vital organs, internal respirations not disturbed, enables patient to cooperate at all times, post-operative complications, such as shock, nausea and vomiting, acidosis and pulmonary infections, are minimized.

In conclusion: Anesthetics and narcotics administered to the well man differ entirely in their effects from anesthetics and narcotics administered to the sick man, therefore, anesthesia cannot be standardized—its application must always be individualized.

(Read at the Ohio State Nurse Anesthetists' Meeting, Columbus, Ohio, April 3, 1935)

# CASE REPORT
# CONVULSIONS DURING ANESTHESIA

Hattie Vickers, Department of Anesthesia, Vanderbilt University Hospital, Nashville, Tennessee

Reports of convulsions during anesthesia have appeared in the literature for the last ten years, the majority of these coming from England. The following case is typical of those reported.

The patient, a well developed white girl, twelve years old, was admitted to Vanderbilt Hospital, December 16th, 1934, with a diagnosis of acute appendicitis, ruptured, general peritonitis. Temperature 103.4, pulse 130, respirations 26, R.B.C. 4,950,000, W.B.C. 16,000.

Preliminary medication: morphia 0.003 gm., atropine 0.0003 gm. The anesthetic—nitrous oxide, oxygen plus ether vapor. The child was cooperative and went quietly to sleep. Ten minutes after the operation had started, the peritoneum was open and relaxation was satisfactory, the muscles about the eyes and face began twitching. There were spasmodic contractions of the muscles of the neck, the head turning to the right. This rapidly progressed to generalized clonic convulsions in which both sides of the body were involved and of equal intensity. The anesthetic was discontinued, carbon dioxide plus oxygen (5-95) was given. The pupils dilated, were irregular and unequal. The twitching did not entirely stop, but was much less as the patient returned to light anesthesia. The pulse rate was 140 and over, with a rapid shallow respiration. The color was good even when the carbon dioxide-oxygen was not being given. It was necessary to give some ether until the peritoneum was closed. The contractions of the muscles became more severe during this time. The anesthetic was then discontinued. After twenty-five minutes, when the twitching stopped, there was a sudden change in respiration, at first jerky or sobbing, which quickly became regular. The pupils suddenly contracted and were equal in size.

The patient was reacting and very restless when returned to the ward. Pulse 160, respirations 28, blood pressure 90-60. Color good. This was at 4:20. At 5:25 there was a convulsion lasting ten minutes, at 7:00 o'clock one lasting two minutes, at 9:00 o'clock one lasting two minutes.

The post-operative diagnosis was acute peritonitis due to pneumococcus. The patient expired the third post-operative day. An autopsy was not obtained. There was no previous history of convulsions or epilepsy in the child, but the maternal grandmother had a history of epilepsy.

The fact that there were three post-operative convulsions may make this not altogether an anesthetic problem, but it is interesting that a convulsion can come on when a patient is well relaxed with ether.

The ether was purchased from an old, reliable company and was taken from a can opened, but well stoppered, several hours before it was used. A sample of this with two fresh cans from the same series was analyzed, with the following results:

1. The test for aldehydes showed traces, but much less than that permitted by the U. S. Pharmacopeia.

2. There were no peroxides present in either the fresh can or that taken from the opened can.

3. The anesthetic potency on mice was normal.


### Summary

A twelve year old white girl with peritonitis developed generalized clonic convulsions during nitrous oxide plus oxygen plus ether vapor anesthesia. There were three similar convulsions after reacting from the anesthetic. There was a family history of epilepsy. Pharmaceutical examination showed no impurities in the samples of ether.


### References


1. Convulsions During Surgical Anesthesia. British Medical Journal, March 14, 1931.

2. Late Ether Convulsions. Journal American Medical Association, April 15, 1933.


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## CONVULSIONS DURING GENERAL ANESTHESIA


Charlotte Duggar, University Hospitals of Cleveland


Convulsions during general anesthesia occur much more frequently than is commonly supposed, and altogether too little is known about the etiology of this complication. It is interesting to note in reviewing the literature, that the convulsions are spoken of, and referred to, as "ether convulsions." The term I believe is misleading, and although the majority of case reports have proved that ether was being used, I feel that it has called attention to ether, meaning to imply the presence of impurities or an idiosyncrasy to the drug. A possible explanation of this may lie in the fact that several years ago ether was the anesthetic of choice. Since the advent, however, of the newer anesthetic agents, convulsions are still being reported, and in this paper I would prefer to refer to this phenomenon as "convulsions in general anesthesia."

In order to discuss convulsions under general anesthesia, it is necessary to ascertain what degree of contraction or series of contractions of the voluntary muscle we are going to refer to as "convulsions." The involuntary contraction or spasm of the muscle commonly seen when certain types of patients are being anesthetized and which directly clear up with the addition of oxygen, followed by an increase in the anesthetic agent, thereby controlling the extreme irritability of the central nervous system, cannot be considered true convulsions in anesthesia. It is true that the movements referred to are convulsive in type, arising probably through a direct stimulation of the center, but unquestionably more could be written about this phenomenon with much more satisfaction to the writer of such a paper than falls to my lot in having chosen to write on the subject of true convulsions in anesthesia, the cause of which is still definitely unknown. The only practical conclusion that can be drawn by stressing the types of convulsions to which we refer is that the

convulsive movements that occur in the early induction stage from a stimulation of the centers can be overcome by deepening the anesthetic. This is also true of a convulsion developing at any time during anesthesia, when the anesthetic is too light, but if a convulsion develops suddenly when the patient is in the second stage of anesthesia, it is extremely dangerous to deepen the anesthesia. The exact cause has been the subject of much speculation, and so long as it would appear to be the spreading of reflexes on the application of small stimuli, it would be and undoubtedly is the safest procedure to lighten the anesthetic, and to give to the patient the least irritating and stimulating anesthetic, with a sufficient amount of oxygen to avoid any possible anoxemia, that can be used to further complete the operative procedure.

In reviewing the literature, we find that the following causes are put forth as possible explanations of this phenomenon: Impurities in ether, particularly aldehyde and peroxide, too high concentration of ether vapor, idiosyncrasy of certain types of patients to ether, over-oxygenation, allowing nerve cells of the medulla to absorb more ether in the presence of excess oxygen; overdosage of anesthetic agent (not exclusively an ether phenomenon); excess carbon dioxide, or alkalosis due to acapnia; possibility of hyperglycemia; increased cerebral vascularity; prolonged anoxemia; atropine over-dosage; acute toxemia; surgical trauma.

It is undoubtedly possible that convulsions have been observed in patients suffering from the above causes, but in my experience, and in a review of convulsions in six cases, out of 12,727 anesthesias, it is my feeling that the anesthetic, although a contributing factor, was not the primary cause, and that the real cause could be attributed to the physiological reaction to the anesthetic under certain pathological conditions.

I shall attempt to discuss these cases from the standpoint of the condition of the patient existing before the convulsion, with the idea of ascertaining if possible a loophole in the administrative technique. In all six cases the anesthetic used was gas-oxygen and ether. The amount of ether varied from a few whiffs to an ounce and one-half; the duration of the anesthesia ranged from five minutes to two hours. The ether used was purchased from an old established firm and was found to be free of aldehydes and peroxides. From the reports of these cases appearing on the anesthesia chart, I believe too high a concentration of ether vapor can be ruled out in view of the type of respiration reported previous to the convulsion. In only one case was the respiration reported as difficult, and that to no alarming degree. The onset of the convulsion in each case was sudden, starting with a twitching about the face and neck muscles, and almost immediately severe colonic or tonic contractions of the entire body. Cyanosis in all cases developed following the convulsion, the seizures lasting from five to eight minutes. In one case, which was an exploration of the lateral sinus, ten days following a simple mastoidectomy, the anesthetic was discontinued and convulsions persisted for a period of over one hour. The blood pressure in all instances fell from 10-50 mm. in systolic and 10-20 mm. in diastolic, previous to, during or directly following the convulsion.

Five of the six cases were emergency operations, four of which were extremely ill patients; temperature ranging from 38 to 41°, respirations from 40 to 55, pulse 100-160.

In three cases the urine was concentrated, showing occasional pus, sugar or albumin. White blood cell count ranged from 10,200 to 17,000. In one case the picture was complicated by arteriosclerosis and one by an enlarged heart and arteriosclerosis. In all cases the incision had been made and from the picture of the anesthetic chart relative to the reaction of the respiration to stimulation, the anesthetic appears to have been controlled. One case, a child aged 15, long-standing osteomyelitis of the arm, developed convulsion during a twenty-five minute anesthetic shortly after the incision was made, the convulsion lasting about five minutes. The anesthetic was continued following the convulsion, and the same technique was used, until the completion of the operation. The patient was returned to bed in satisfactory condition, and two days later he was again anesthetized without any complications, and in nine instances thereafter before the patient left the hospital similar operations were performed under general anesthesia without any return of convulsive seizures.

The report of these cases covers the entire number of instances in which it has occurred in a series of 12,727 cases. This represents a percentage of 1–20th of 1 per cent.

The total number of anesthetics includes ether, gas-oxygen, gas-oxygen-ether, with and without the soda lime filter, avertin, local and spinal.

It is interesting to note that in every instance the patients were either acutely ill, extremely ill, or poor risks.

From the standpoint of the administrative technique we of course recognize the fact that the physiology of the body is greatly disturbed during any anesthetic if prolonged anoxemia exists or if too high a concentration of ether vapor is given, or excess or lack of carbon dioxide is tolerated. It is apparent, however, that with modern methods of anesthesia and with careful technique that these factors can be overcome and it is my feeling that when convulsions occur it is more likely to be due to the disturbance of the normal physiology of the body from toxemia than to any other cause. Under such conditions the increase of the carbon dioxide output and the higher percentage of oxygen necessary in the presence of the disturbed metabolism must be constantly kept in mind, and the administrative technique controlled as much as possible to prevent an over-stimulation of the central nervous system from any cause, particularly from any degree of asphyxiation. Convulsions that appear in the patients with more normal response are not usually of serious import, and if fatalities are to be avoided in the extremely ill patients with high temperatures, disturbed metabolism, et cetera, great care must be resorted to in the administrative technique that every precaution is taken to prevent as nearly as possible any condition that is put forth as a possible cause of this complication.

(Read at Ohio State Nurse Anesthetists Meeting, April 3, 1935)

# CARBON DIOXIDE HYPERVENTILATION

Ann M. Nightengale, City Hospital, Cleveland.

Extensive investigations by physiologists in America and Europe have established the fact that carbon dioxide is not merely a waste product, but performs a distinct role as a chemical regulator of various functions. The carbon dioxide content of the blood according to Henderson exercises regulative influences upon the heart rate, upon the vascular tonus, upon the peristalsis of the alimentary canal, upon the mental condition, and upon a number of other functions of the body. A slight reduction in the carbon dioxide content of the arterial blood causes a marked quickening of the heart rate; further reduction induces an extreme tachycardia, complete cessation of peristalsis, failure of many reflexes, and coma; and if an extreme reduction is effected rapidly the heart develops a state bordering on tetanus. The regulation of the carbon dioxide tension of the air in the pulmonary alveoli, and the extent to which carbon dioxide is eliminated from the blood in its passage through the lungs are important factors in the prevention of shock.

The average tension of carbon dioxide in alveolar air determined by actual tension under which the gas is evolved from the blood, is less than the average tension of carbon dioxide in alveolar air during the time of the respiratory cycle. As carbon dioxide accumulates and oxygen is consumed in a confined space, the breathing becomes intensified. In searching for the exact cause of this effect we must first of all ascertain whether the hyperpnea is due to the deficiency of oxygen or the accumulation of carbon dioxide or both acting together. If an individual is placed in a large air-tight chamber, 2000 litres capacity, and the breathing observed as the carbon dioxide accumulates and the oxygen in the air is consumed, no change is noticed until the carbon dioxide percentage has risen to about 6 and the oxygen fallen to 13.5 when dyspnea develops to an unbearable degree. This proves that carbon dioxide acts as a stimulant. Under the same experiment but utilizing soda lime as an absorbing agent no hyperpnea developed.

Henderson and Haggard have observed that deep breathing, induced by the inhalation of 5-7 percent carbon dioxide, diluted in every case with oxygen or air, dilates the lungs and thus prevents or relieves atelectasis. They suggest that carbon dioxide inhalations are indicated in the following conditions in which atelectasis and pneumonia are associated:

(1) The newborn. The newborn infant is benefited by the inhalation of 5 to 7 percent carbon dioxide with oxygen.

(2) Postoperative pneumonia. Pneumonia can be almost entirely eliminated by the routine inhalation of carbon dioxide after the termination of the operation and anesthetic. The utilization of carbon dioxide without pure oxygen is approved in general surgical practice, in which it is mixed with ordinary atmospheric air.

(3) Carbon monoxide asphyxia. This condition is relieved by the early inhalation of carbon dioxide, which also causes a notable decrease in post-asphyxial pneumonia.

(4) Lobar pneumonia. This process is a simple pneumococcic atelectasis. This atelectasis can be relieved by aspirating the bronchi through the bronchoscope and then by administering carbon dioxide, after which the heart will return to its normal position. Shallow breathing and accumulation of mucus is the critical morbific factor in producing atelectasis, and the condition is characteristic of an undrained infection. By relieving atelectasis the early inhalation of carbon dioxide seems to be effective in the treatment of pneumonia.

After anesthesia and carbon monoxide asphyxia alike, the respiration tends to be depressed. During this period of shallow breathing, parts of the lung may remain unventilated and thus become atelectatic. Pneumonia may develop in these areas unless special measures are taken for their reinflation. The distention of these unventilated and collapsed areas by the deep breathing which inhalation of carbon dioxide produces counteracts the atelectasis and prevents the development of pneumonia.

Dr. G. S. Bergh, in an article in Minnesota Medicine for 1933 states that atelectasis in some degree is a frequent post-operative complication. The most widely used prophylactic procedures are hyperventilation induced by administration of carbon dioxide, and postural measures, including frequent changes of position to prevent accumulation of secretions in dependent portions of the lung and in cases in which there is copious secretion, postural drainage. The inhalation of carbon dioxide produces an increase in the rate and depth of respiration and also causes the thorax to be maintained in a state of greater expansion, which distends the lung and tends to open areas of atelectasis. It also produces violent movement of the tracheo-bronchial tree, tends to dislodge adherent mucus and thus opens the air passages. The effects of carbon dioxide inhalation are transient and disappear when the administration of the gas is discontinued. Since the beneficial results are temporary, it is recommended that hyperventilation be repeated at frequent intervals. In most cases three or four administrations a day are sufficient, but there are a considerable number of patients who require more frequent hyperventilation. It is suggested that each administration be continued over a period of three minutes, with a mixture of 10 per cent carbon dioxide and 90 percent oxygen.

Dr. Flood, San Francisco, California, states that there are two factors in the prophylactic use of carbon dioxide, namely, keeping the bronchi free of mucus plugs and then placing the patient in a position so that when the carbon dioxide liberates the tenacious mucus it will drain toward the mouth and be expectorated. This is easily accomplished by lowering the head of the patient. Carbon dioxide will break up and move tenacious plugs but the position of the lungs must be so that internal drainage into other parts is not established. In his observation of 82 cases of tonsillectomy where this method was followed there was an incidence of 4.8 percent of post-operative respiratory complications as against 8 percent in 75 cases observed where postural prophylaxis alone was used.

Dr. Mackenzie in the British Medical Journal of 1932 reports his experiences in 5000 cases in which carbon dioxide was administered in

combination with general anesthesia. Among the advantages that accrue to the surgical patient three stand out prominently:— (1) the prophylactic action of carbon dioxide against the onset of respiratory complications, irrespective of the anesthetic agent used, (2) the protection afforded to patients who are operated upon with concomitant respiratory disability, and (3) the curative action of carbon dioxide when postoperative respiratory complications have occurred. For purposes of observation the cases were arranged in four groups. In the first and largest group carbon dioxide to the extent that appeared advantageous to the patient was administered in the operating room during the induction, the maintenance and the recovery stages of gas-oxygen and ether anesthesia. In the second group, carbon dioxide was used in the induction and recovery stages of deep ether anesthesia. In the third group, carbon dioxide was used as a prophylactic against respiratory complications during the recovery stage in the operating room and in the ward after the operation. In the fourth group, carbon dioxide was administered as a therapeutic agent in cases of post-anesthetic respiratory complications. The tendency has been for the first three groups to merge into one, and recently, as far as it was possible, the patients had carbon dioxide during the induction of and the recovery from anesthesia in the operating room and in the ward, at regular intervals throughout the first 24 to 36 hours after the operation. The author has evolved the following technique of administration:— (1) Pulmonary ventilation is controlled and regulated to the normal during the induction and maintenance of anesthesia. (2) During the closing stages of the operation, hyperventilation and deetherization is carried out until the patient leaves the operating room. (3) In the ward the administration consists of the inhalation of carbon dioxide and oxygen for 5 minute periods. These periods are continued at intervals of from 4 to 6 hours throughout the first 24 to 36 hours after the operation. (4) This periodic administration is continued if there is any evidence of respiratory complication. The percentage of carbon dioxide, the duration of the period, and the frequency of administration should be regulated according to the tolerance of the individual patient. The freedom from pain in abdominal wounds during hyperventilation with carbon dioxide as compared with the pain and distress which the patient endures in voluntary deep breathing is a marked feature of the administration.

The following is taken from the report of Henry K. Beecher, M.D., in the Journal of Surgery, Gynecology and Obstetrics for November 1934. "Studies of post-operative pulmonary complications have been concerned chiefly with compilations of hospital records or investigations of the effects of laparotomy on the respiratory system. Laparotomy produces certain profound changes in the respiration:—(a) marked reduction in the tidal air, (b) sharp increase in respiratory rate, (c) slight but not significant change in total ventilation, (d) rapid, shallow type of respiration which sets up a vicious cycle tending to increase further the respiratory rate, (e) great reduction in complemental air, greater following upper than lower abdominal operations in both men and women, (f) great reduction in supplemental air, greater following upper than lower abdominal operations in men but not in women, (g) about the same degree

of crippling of the mechanism of forced inspiration and of forced expiration, (h) great reduction in vital capacity, the greater crippling in both sexes following upper abdominal operations, and greater crippling in men than in women, (i) marked decrease in subtidal lung volume and in maximum lung volume. These pulmonary changes as enumerated indicate severe injury of the respiratory function. Several methods of therapy have been designed to counteract the imperfect ventilation of the lungs indicated by the above data. Fifty cases were studied—22 patients received carbon dioxide treatment after laparotomy and 28 used as controls, received no treatment. Of the patients treated there were 8 men and 14 women; of the controls 10 men and 18 women. Of the treated patients 11 underwent upper abdominal operations or herniorrhaphies, while in the control group 11 submitted to upper abdominal operations and 17 to lower. Post-operative carbon dioxide therapy consisted in a post-operative routine of treatment lasting 3 or more days, starting after the patient had been returned to the ward. In all cases each treatment produced marked hyperpnea and was continued as long as the individual could endure it. Half of the patients were treated by a method which consisted in having them rebreathe their own carbon dioxide through an 8-foot tube 3 times daily. Here, the limit of tolerance was 2-3 minutes for each treatment. The second half of the group received carbon dioxide from a tank through a face funnel 5 to 8 times daily, violent hyperpnea was attained more slowly and they could endure the treatment from 5 to 10 minutes. The data on vital capacity showed no significant difference between the cases in which patients were treated 3 times daily and in those receiving more treatment. In the cases studied, carbon dioxide therapy following laparotomy had no effect in preventing the crippling of the respiratory system."

Theoretically and experimentally there is considerable evidence to indicate that the use of carbon dioxide for post-operative hyperventilation should serve to minimize post-operative pulmonary complications. From a clinical standpoint there is some variation in opinion as to the actual value of hyperventilation. There are no sufficiently well controlled series of cases with and without hyperventilations to enable us to draw any positive conclusions.

(Read at Ohio State Nurse Anesthetists' Meeting, Columbus, Ohio, April 3, 1935)

**At a meeting of the Board of Trustees of the American Hospital Association held on February 18th, 1935, the following resolution was adopted:**

**"RESOLVED, That it is the judgment of the Trustees of the American Hospital Association that any legislation which bars, or tends to bar, the use of properly trained anesthetists would be a mistake and a step backward."**

# OBSTETRICAL ANALGESIA AND ANAESTHESIA

Mary M. Lust, formerly at Maternity Hospital, Cleveland, Ohio

In the past, women have been denied relief from the agony of labor, usually because of prejudice or religious beliefs. Lately there has been a great deal said and written against the use of analgesia and anesthesia in obstetrics. There seem to be two reasons advanced against its use, namely: (1) retardation of labor; (2) danger of anaesthetics to mother and child.

Under the direction of Dr. Arthur H. Bill, a series of experiments with patients in labor have been carried out. By means of the hystograph it was possible to have a clear picture of the different effects of drugs upon the contractions. These charts indicate definitely that while certain drugs do slow up contractions temporarily, the total length of labor is not increased to any great extent if the drugs are properly given.

A comparative study of patients' charts was made: (1) those who were delivered at Maternity Hospital and were given analgesia; (2) an equal number delivered in the home where ether was given only for the actual delivery. This study brought out that labor was shorter in the hospital.

The dangers of anaesthetics to mother and child are therefore our most serious consideration. We teach that there are dangers in obstetrical analgesia and anaesthesia, but with careful selection of drugs and proper care, these dangers can be eliminated.

The term "analgesia" as used at Maternity includes all medication given during labor to the beginning of anaesthesia. The idea is to keep the patient comfortable through her entire labor without danger to her or the baby.

The patients are instructed to come to the hospital as soon as contractions are felt and are from five to ten minutes apart. After a report to the obstetrician full preparation is given. The patient is then transferred to a cool, quiet, well ventilated room, and placed on a comfortable bed. Her husband is permitted to visit her until she feels her contractions are severe, when an order for some type of medication is obtained.

Patients having their first babies are usually given the morphine and scopolamine routine. That is:

(1) morphine gr. 1–6 )hypodermically
scopolamine gr. 1–150 )
(2) scopolamine gr. 1–200 45 minutes after first dose
(3) scopolamine gr. 1–400 45 minutes after second dose
(4) scopolamine gr. 1–400 every 1½ hours until contra-indicated

Contra-indications:

(1) Full dilatation or probability of rapid dilatation. We strongly advise not to deliver the baby until three hours after the last dose of scopolamine and four hours after morphine. This is to avoid any depressing effect upon the baby, and great care should be taken that scopolamine or morphine not be given when patient is too far advanced in labor.

(2) Varying fetal heart—usually indicating fetal distress and obstetrician may have to deliver at any moment, so that scopolamine should not be given.

(3) Bleeding of patient which might be premature separation, or placenta praevia and at any time necessitate immediate delivery—scopolamine should not be given.

(4) Psychic reaction—a very few patients react poorly to scopolamine, become excited, or have bad dreams, and are difficult to manage. It is advisable to discontinue scopolamine and give some other medication.

The patient is usually comfortable on the morphine and scopolamine until full or almost full dilatation. The patient sleeps between the contractions, but will move around during contractions. As labor progresses and contractions become more severe a supplementary form of analgesia may be given if the patient appears conscious of pain. If dilatation of cervix seems slow morphine is sometimes repeated, which, with the scopolamine, usually keeps the patient comfortable from two to four hours longer.

Ether may be supplemented whenever the morphine and scopolamine are not sufficient for patient's comfort. The ether is given during contractions, the amount depending upon the severity of the contractions. Colonic ether may be given if for some reason the patient does not react well to inhalation ether. Nitrous oxide-oxygen inhalations are given if it is preferred to ether.

Patients who are multiparae are not usually given morphine and scopolamine unless the obstetrician anticipates a long labor. As soon as contractions become severe the patient is given sodium amytal grs. 9, either by mouth or per rectum. This will probably keep her comfortable for about two hours, when ether inhalations, colonic ether, or gas inhalations may be given. In some cases a supplementary analgesia must be given as well as the sodium amytal. This does not always mean that the sodium amytal has failed. It usually lessens the excitement of the patient and permits her to sleep quietly between contractions.

The administration of analgesia, during labor, is an art in itself. It is best accomplished by one well trained in anaesthesia and in obstetrical nursing. Ether is the most generally used anaesthetic. It is given in a very simple manner which, however, requires much patience and practical experience before one can hope to approach the ideal in administration of obstetrical analgesia.

The closed cone (modification of the handkerchief cone) is used, which gives a greater volume in a given time. Cover patient's eyes with a towel. Apply cold cream to the face and lips. Pour one to two drams of ether on gauze pad in cone; close the cone with one hand, keeping the other hand on patient's abdomen. As soon as contraction is felt (before patient feels any pain), slowly lower the cone over patient's face. Remove the cone as soon as contraction is over and drop ether, enough for the next contraction. If the ether is properly given the patient will not be conscious of pain; she may move or groan a little, but will have no memory of doing so.

The patient may dislike the odor of ether, or have a respiratory infection, in which case nitrous oxide and oxygen may be given. Gas is

not always a success. It is very difficult to keep a patient entirely comfortable with intermittent inhalations. In second stage when contractions are close and severe it is sometimes necessary to give a small amount of gas constantly.

The choice of anaesthetic for the actual delivery depends upon the type of delivery, preference of the patient, and reaction of the patient. For the average case ether has been the anaesthetic used; given with the cone, the varying depths of anaesthesia required for the delivery are quickly carried out. If for any reason nitrous oxide-oxygen seems suitable for a particular case, there is no hesitancy in changing.

The difficulties of obstetrical anaesthesia are those of any emergency case. Food or fluid in the stomach, with all the complications it implies, is not an uncommon occurrence. True, the patient is warned not to eat solid food once her contractions begin; but with a very healthy appetite and only fifteen-minute contractions, it is often too great a temptation. Once contractions start, digestion is slow, and in some cases seems to stop, so that partially digested food, though eaten ten to twenty hours before, can easily complicate any anaesthetic. Quite often the patient will vomit this food early in labor, and in light analgesia is able to get rid of it without aspiration. Vomiting during anaesthesia causes alarm. The patient may be fairly well anesthetized, but stimulation of the perineum produces a vomiting reflex. The patient is not able to get rid of this fluid or food without danger of aspiration. This, of course, should be avoided, and can be in most cases if the anaesthetist is alert, not only to signs of anaesthesia, but to the obstetrical procedures which are being carried out. The patient's head is always turned to one side during anaesthesia, and a gauze mouth bite placed between the teeth. If, in spite of all care, the patient starts to vomit during the anaesthesia, a size 22 catheter with end and side opening may be passed, avoiding danger of aspiration. The catheter may remain in place during the entire anaesthetic.

Patients with chest conditions, colds, or sinus infection are not given ether. Nitrous oxide-oxygen is given and with use of atropine these cases give very little trouble.

Nausea and vomiting is rarely remembered by the patient. Except Caesarean Sections, all patients are given tepid water as soon as awake. The first glass usually acts as a lavage, emptying the stomach of old secretions and mucus. The patient will then retain any food or fluid given her.

If there is any doubt in one's mind about the value of a comfortable labor, a visit should be made to the patient the day after delivery. Instead of a tired-out, old-looking, morbid young woman who says, "Never again," one finds a cheerful young mother who already has found time to apply a bit of rouge and lip-stick, who says, "When do you think I should have my next baby? An only child is always spoiled!"

It isn't less anaesthesia that we need for the woman in labor, but better anaesthesia. To have better anaesthesia it must be given by those not only thoroughly trained in anaesthesia but thoroughly trained in obstetrics.

(Read at second annual meeting Ohio State Association of Nurse Anesthetists, April 17, 1934)

## ACTIVITIES OF STATE ASSOCIATIONS

The second annual meeting of the New York State Association of Nurse Anesthetists will be held in conjunction with the New York Hospital Association, May 23rd and 24th, 1935, at the Hotel New Yorker, New York City.

President—Miss Cora McKay, Albany Hospital, Albany, N. Y.

Secretary-Treasurer—Miss Ida M. Edwards, Strong Memorial Hospital, Rochester, N. Y.

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The fourth annual meeting of the Pennsylvania State Association of Nurse Anesthetists will be held in conjunction with the Pennsylvania Hospital Association, May 8th to 10th, 1935, at the Bellevue-Stratford Hotel, Philadelphia, Pa.

President—Miss Mary E. Walton, 3344 Fifth Ave., Pittsburgh, Pa.

Treasurer—Miss Frances Shellenberger, 3344 Fifth Ave., Pittsburgh, Pa.

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The Minnesota State Association of Nurse Anesthetists was organized on January 29th, 1935, in St. Paul, Minn., and the following officers were elected:

President—Miss Ruth Bergman, Mounds Park Hospital, St. Paul, Minn.

1st Vice-President—Miss Kathleen Cleary, St. Luke's Hospital, St. Paul, Minn.

2nd Vice-President—Miss Alice Berg, University Hospital, Minneapolis, Minn.

Secretary—Miss Mina Sponheim, Northwestern Hospital, Minneapolis, Minn.

Treasurer—Miss M. Helen Baggot, St. Marys Hospital, Minneapolis, Minn.

The February meeting of the Association was held at Northwestern Hospital, and was enthusiastic and well attended. The March meeting was held in St. Joseph's Hospital, St. Paul; speakers, Dr. George Geist and Dr. Wm. Carroll.

The first annual meeting of the Minnesota State Association will be held in Duluth, Minn., June 20th, 1935, in conjunction with the Minnesota Hospital Association. The following will appear on the program: Dr. A. F. Brandon, Willmar, Minn.; Dr. S. H. Bryer, Jr., Duluth, Minn.; and Dr. F. J. Hirschbreck, Duluth, Minn.

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The California State Association of Nurse Anesthetists was reorganized on March 3rd, 1935, at St. Mary's Hospital, San Francisco, Cal., and the following officers were elected:

President—Miss Myra Belle Quarles, Childrens Hospital of the East Bay, Oakland, Cal.

Vice-President—Miss Margaret McCoppin, Sutter Hospital, Sacramento, Cal.

Secretary-Treasurer—Miss Martha Guptill, Samuel Merritt Hospital, Oakland, Cal.

Trustees: Mrs. Vyevene Ellis, St. Francis Hospital, San Francisco, Cal.; Miss Sarah Rausch, Mary's Help Hospital, San Francisco, Cal.; Mrs. Irene F. Krekeler, Samuel Merritt Hospital, Oakland, Cal.; Miss May Malamphy, St. Mary's Hospital, San Francisco, Cal.

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The Missouri State Association of Nurse Anesthetists was organized on February 5th, 1935, at Barnes Hospital, St. Louis, Mo., and the following officers were elected:

President—Miss Helen Lamb, Barnes Hospital, St. Louis, Mo.; 1st Vice-President—Mrs. Kathleen Richardson; 2nd Vice-President—Miss Sylvia C. Cole, Jewish Hospital, St. Louis, Mo.; Secretary—Miss Anna L. Gettinger, St. Louis City Hospital, St. Louis, Mo.; Treasurer—Miss Evelyn Hurff, Barnes Hospital, St. Louis, Mo.

Trustees—Miss Anna Cox, Missouri Baptist Hospital, St. Louis, Mo.; Miss Emma Koehler, Robert Koch Hospital, Koch, Mo.; Miss Jessie Lindsey, 4468 Forest Park Blvd., St. Louis, Mo.; Mrs. Louisa L. Jekel, City Hospital No. 2, St. Louis ,Mo.

The next meeting of the Missouri Association was held on April 5th, at Barnes Hospital, St. Louis, Mo.

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The second annual meeting of the Ohio State Association, held in conjunction with the Ohio Hospital Association, at the Deshler-Wallick Hotel, Columbus, April 3rd and 4th, was well attended and enthusiastic. The following officers were elected for the year 1935-1936:

President—Miss Lucy Richards, Lutheran Hospital, Cleveland, Ohio.

1st Vice-President — Sister Alexandrine, St. John's Hospital, Cleveland, Ohio.

2nd Vice-President—Miss Gladys Bolton, Akron City Hospital, Akron, Ohio.

Secretary-Treasurer—Miss Marion Hollister, University Hospitals, Cleveland, Ohio.

Trustee—Mrs. Mary A. Ware, Children's Hospital, Cincinnati, Ohio.

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The Fort Worth, Texas, District Association of Nurse Anesthetists have held monthly meetings throughout the year, including two social meetings. Addresses were given by doctors, followed by a round table discussion. Much enthusiasm and sustained interest has been manifested by this small but active group;—Miss Ola Olmstead, The Coffey Clinic, Fort Worth, Texas, Secretary.

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The Dallas, Texas, District Association of Nurse Anesthetists was organized on March 19th, 1935.

President—Miss Lucille Mullen, Parkland Hospital, Dallas, Texas. Secretary—Miss Beatrice Mills, St. Paul Hospital, Dallas, Texas.

Meetings will be held in April, May and June and resumed in the fall.

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